several lamps in series. It is brought into play by the switch, C D, which can be placed at E or D. When it is at E, the negative terminal, A, is in communication with the positive terminal, B, through the resistance, R, which equals the resistance of the lamp, which is therefore out of circuit. When it is at D the cut-off acts automatically to do the same thing when required. This is done by a solenoid, V, which has two coils, the one of thick wire offering no resistance, and the other of 2000 ohms resistance. The fine wire connects the terminals, A′ and B. The solenoid has a movable soft iron core suspended by the spring, U. It has a cross piece of iron which can dip into two mercury cups, G and K, when the core is sucked into the solenoid. When this is the case, which happens when any accident occurs to the lamp, the terminal, A, is placed in connection with the terminal, B, through the thick wire of V and the resistance, R, in the same way as it was done by the switch, C D.

Electrical Arrangement.—The mode in which several lamps are connected up in series is shown by Fig. 6. M is the dynamo-machine. The + lead is connected to B_1 of the balance, it then passes to the lamp, L, returning to the balance, and then proceeds to each other lamp, returning finally to the negative pole of the machine. When the current enters the balance it passes through the coil, S, magnetising the iron core and drawing it downwards (Fig. 4). It then passes to the lamp, L L′, through the carbons, then returns to the balance, and proceeds back to the negative terminal of the machine. A small portion of the current is shunted off at the point, P, passing through the coil, S′, through the contact spring, T N, to

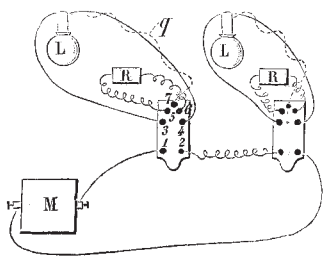

FIG. 6.

the terminal, A′, and drawing the iron core in opposition to S. The carbons are in contact, but in passing through the lamp the current magnetises the electromagnet, M (Fig. 2), which attracts the armature, A B, that bites and lifts up the rod, T, with the upper carbon a definite and fixed distance that is easily regulated by the screws, Y Y. The arc then is formed, and will continue to burn steadily as long as the current remains constant. But the moment the current falls, due to the increased resistance of the arc, a greater proportion passes through the shunt, S′ (Fig. 4), increasing its magnetic moment on the iron core, while that of S is diminishing. The result is that a moment arrives when equilibrium is destroyed, the iron rod strikes smartly and sharply upon the spring, N T. Contact between T and H is broken, and the current passes through the electromagnet of the break in the lamp. The break is released for an instant, the carbons approach each other. But the same rupture of contact introduces in the shunt a new resistance of considerable magnitude (viz. 1200 ohms), that of the electromagnets of the break. Then the strength of the shunt current diminishes considerably, and the solenoid, S, recovers briskly its drawing power upon the rod, and contact is restored. The carbons approach during these periods only about ·01 to ·02 millimetre. If this is not sufficient to restore equilibrium it is repeated continually, until equilibrium is obtained. The result is that the carbon is continually falling by a motion invisible to the eye, but sufficient to provide for the consumption of the carbons.

The contact between N T and H is never completely broken, the sparks are very feeble, and the contacts do not oxidise. The resistances inserted are so considerable that heating cannot occur, while the portion of the current abstracted for the control is so small that it may be neglected.

The balance acts precisely like the key of a Morse machine, and the break precisely like the sounder-receiver so well known in telegraphy. It emits the same kind of sounds, and acts automatically like a skilled and faithful telegraphist.

This regulation, by very small and short successive steps offers several advantages: (1) it is imperceptible to the eye; (2) it does not affect the main current; (3) any sudden, instantaneous, variation of the main current does not allow a too near approach of the carbon points.

Let now an accident occur, for instance, a carbon is broken. At once the automatic cut-off acts, the current passes through the resistance R instead of passing through the lamp. The current through the fine coil is suddenly increased, the rod is drawn in, contact is made at G and K, and the current is sent through the coil, R. As soon as contact is again made by the carbons, the current in the coil S is increased, that of the thick wire in V diminished, and the antagonistic spring, U, breaks the contact at G and K. The rupture of the light is almost invisible, because the relighting is so brisk and sharp.

I have seen this lamp in action, and its constant steadiness leaves nothing to be desired. W. H. PREECE

THE SANITARY INSTITUTE

THE Inaugural Address delivered by Captain Douglas Galton at the opening of the Congress of the Sanitary Institute of Great Britain at Newcastle-upon-Tyne, traces the growth of the more important questions relating to public health and to the prevention of disease from remote times down to recent date, and it is, both historically and otherwise, of much interest. Questions of public health have for many years past received increasing attention in this and other countries, and the energies of some of the ablest intellects have been devoted to the investigation of the various circumstances which tend to injure the health of communities. Some have dealt with the subject from a purely scientific point of view, others have given their attention especially to the defects in works of construction, such as systems of sewerage and water-supply, which have led to the spread of disease, and many physicians have devoted themselves exclusively to those branches of medical science which deal with preventive as opposed to curative medicine. Captain Galton refers to many of these researches, and shows how they have tended to secure for us our present knowledge. Dr. Tyndall's well-known investigations as to the existence of low forms of life in the dust contained in air, and his studies on putrefaction are recorded, as also Dr. Bastian's and Mr. Lister's kindred labours, and the practical applications to which they may be put. The several discoveries as to the connection of disease with definite organisms are noted; Professor Koch's recent contributions as to the organisms associated with tubercular disease closing this subject, in point of time. M. Pasteur's discoveries in connection with fowl-cholera and anthrax in cattle, and the associated question of the attenuation of the infectious property of the virus of these diseases, as the result of the processes to which they are subjected are dealt with in some detail. As to accepting M. Pasteur's conclusions in their entirety, it may however be desirable to await further experiments, the more so as certain investigations of Dr. Klein, an account of which has recently been submitted by the Local Government Board to the Veterinary Department of the Privy Council, have tended to conclusions adverse to the general adoption of M. Pasteur's proposal to inoculate

cattle with an attenuated virus as a protection against anthrax. Knowledge as to these subjects is shown in the address to be rapidly increasing, but it is maintained that the science of the prevention of disease advances quite as rapidly as the knowledge relating to its causation. Thus, the application of systems of sewers is shown by statistics to have led to a great decrease in enteric or typhoid fever, both in this and other countries, and it is rightly contended that where a similar result has not followed on such provision, defective and faulty methods of construction, and not the systems as such, must be held responsible. The improvement in the water-supplies for our towns and villages has in like manner led to much saving of life and health, but dangers still lurk even in our modern systems of supply, and some of them are extremely difficult of detection. As to this subject Captain Galton says he is disposed to think that there has never been a well-proved case of an outbreak of disease resulting from the use of drinking water, where the chemist would not unhesitatingly on analysis have condemned the water as an impure source. The inference here implied must unquestionably be regarded as considerably in advance of that which our more eminent chemists themselves would lay claim to. Indeed, Dr. Frankland has distinctly admitted that chemical analysis is unable to detect those small quantities of morbific matter which are capable of conveying disease, and he has himself mingled choleraic dejecta with water without being able to detect any noteworthy chemical alteration in its quality. The standard which should be aimed at in this matter of water-supply is the same as that advocated by Captain Galton in other matters such as sewerage, ventilation, &c., and that is to get rid of all conditions involving risk, rather than to hope that their influence for mischief may never have opportunity for manifesting itself. The address gives many instances, whether in connection with Indian fairs or elsewhere, to show that scrupulous cleanliness should be the aim of sanitarians, and this is at least as desirable in connection with water services and watercourses as elsewhere.

The address having been delivered at Newcastle-upon-Tyne, it was but natural that frequent reference should have been made to sanitary administration in that borough, and to the results attendant upon it. The need for the isolation of infectious diseases is a matter of public concern, which called for and received attention, and it is satisfactory to note from the recently issued Report of the Medical Officer of the Local Government Board, that a considerable proportion of the sanitary authorities in England have already recognised the necessity for making some provision for the removal of the infectious sick from amongst crowded communities. But it is also evident that the accommodation provided should be of an efficient character. At Newcastle there is hospital provision for the infectious sick, but we fear that even whilst the Congress is sitting, the inadequacy of the accommodation available there is causing anxiety to those who are responsible for the health of the borough. The extension of sanitary hospitals to every part of the kingdom is much to be desired, and the suspicion of their possible influence for evil which is adverted to in the address, need not in any way hinder action in this direction. The only disease which has ever been alleged to extend from such hospitals to the surrounding neighbourhoods is small-pox, and even that disease is not suspected of having any such influence except when a large number of patients are aggregated together. The very essence of these hospitals is to have them in actual readiness, so that first attacks being at once isolated any further spread is prevented; and if by any chance this becomes impossible, it is, to say the least, doubtful whether, the disease having once extended, we have not in vaccination an even more potent method of prevention than isolation can at such a stage afford. The compulsory notification of infectious diseases will some day come powerfully to the aid of isolation as a measure of prevention, but public opinion as yet hardly appears ripe for any general measure to that effect.

In the concluding portion of his address Captain Galton endeavoured to convince his audience of the truth of the aphorism that public health really means public wealth. The advantages of dealing efficiently with the refuse of the population by sewage farms and otherwise was pointed out, and some of the results indicated went clearly to show that after all filth is but matter in a wrong place. The saving of life and health amongst persons inhabiting our model dwellings and improved lodging-houses was also shown to be striking, and it needs but little argument to prove that a distinct pecuniary advantage accrues to the community which can, by providing proper dwellings for the poor, retain amongst them, and in health, the bread-winners of each family. A large death-rate always means a heavy sick-rate and an increased poor-rate, and there is no form of death-rate which indicates a greater loss to a district than that which results from those infectious diseases which find their victims amongst the youth and adult members of the population. Fortunately it is these diseases above all others which are most easily prevented by the adoption of an intelligent and efficient sanitary administration.

NOTES

WE regret to have to record the death, at the age of forty-three years, of M. Georges Leclanché, the inventor of the oxide of manganese constant elements, which are used so largely all over the world.

DR. OSCAR DICKSON has purchased and presented to the Botanical Museum at Upsala the magnificent collection of Scandinavian mosses and algæ which the two Swedish naturalists, Messrs. J. and C. Hartman had collected during sixty years. The three botanical collections which form the basis for the study of the Scandinavian flora, viz., the Fries, Hahlenberg, and Hartman are now, by this last donation, in the possession of the University of Upsala.

THE inauguration of the Becquerel statue took place on Sunday at Chatillon-sur-Loing, a small country town of the Montargis arrondissement, in the department of Loiret, where the eminent electrician was born in 1788, and where his family are still living. The statue represents Becquerel holding in his hands the small apparatus of which he made use for producing by electrical agencies his artificial crystals. On the pedestal is carved the names of the principal battles which Becquerel fought when in the French army, which belong mostly to the campaign of 1813, especially the siege of Saragossa. M. Cochery, the Minister of Postal Telegraphy, who is the representative of Chatillon-sur-Loing in the French Lower House, delivered the inaugural speech—an eloquent address, summarising the principal discoveries of Becquerel, and insisted on the services rendered by him to the cause of telegraphy. M. Dumas, the President of the Committee for erecting the statue, having been unable to attend the meeting, sent a written address, which was read on his behalf by M. Daubree, Director of the School of Mines. In this eloquent address the Perpetual Secretary of the Academy of Sciences presented a picture of the results obtained by modern industry and drew a most ingenious parallel between the Greeks and Romans erecting statues to demigods, and the modern nations conferring the same honours on the real benefactors of mankind. He eulogised Guillaume, the eminent artist, whose masterpiece was offered to the inhabitants of Chatillon to commemorate the life of a great man. M. Fremy advocated the cause of the Museum. He reminded the audience that just fifty years ago the lectureship occupied by